

# The Washington Post

SATURDAY, JUNE 17, 1967

## Science and Man . . . By Joshua Lederberg

### The Future of Agriculture

MADISON, Wis.—Thoughts from a commencement platform:

It is hard to imagine a more uncomfortable ritual than to don a doctoral hood over an academic gown already too warm under the June sun. Nor does the ancient ceremony really succeed in distracting anyone from the overwhelming news of the time: the rare though perhaps evanescent success of military force where diplomacy had failed to protect freedom and dignity.

An honorary degree to a onetime professor is a mere gesture, devoid of measurable substance; but at the same time, it is a magnificent reunion with old friends and colleagues and, above all, with the University itself. As the graduates file by to collect their sheepskins, I fall into reverie what this process is all about, daydream how Wisconsin is a microcosm of the world's problems.

FOOD IS the nexus. The great university has grown from a cow college — the School of Agriculture where I taught for 11 years. Its national eminence for scholarly inquiry is the flowering of a union of 19th century liberalism with an early dedication to scientific research in agriculture.

The farm is still a potent myth in the state's image of itself and in its politics, far out of proportion to the economic or demographic importance of rural life in the present era. Nor is the myth



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wholly innocuous: I have seen many bitter regrets among students who had made a wrong commitment to an "easy" course in agriculture when the facts proved out the statistical odds against their going back to the farm.

The other great news of the day connects with that myth. Possibly last among the states, Wisconsin law now finally permitted the sale of butter-colored m<sup>u</sup>g<sup>g</sup>er<sup>n</sup>, restricted for years as an artificial protection to a dairy industry dedicated to butterfat. This itself is a fascinating paradox.

An early contribution of agricultural science was the development of a practical test for butterfat in milk by Stephen Babcock. This helped protect the consumer against skimming or watering of the product. It was the foundation of dairy marketing and economics.

Meanwhile, we have seen a striking shift in dietary habits (or at least of aspirations) on the part of adults, and many take great pains to eliminate butterfat from any milk they drink. The "synthetic butter" industry has also seriously eroded the demand for milk fats.

THE RACE between food and population is perhaps the most fundamental issue in global human affairs. We have read many divergent forecasts and we certainly need to be prodded by gloomy ones to have any hope of doing what is needed to achieve happier ends. In practice, we will doubtless mount a marginally effective response, with the world's average food supply continuing to run just behind the need.

And beyond that average, local fluctuations in rate of production, crop failures, ineffective distribution and barely timely responses will continue to create pockets of starvation. We will torture ourselves whether to grow and export more surplus food to meet this month's needs of hungry babies, and then ask how this aid subverts the aim of agricultural self-sufficiency.

Suppose, then, that by heroic effort we could help accomplish that sufficiency throughout the underdeveloped world. This would entail the long-term commitment of immense human and capital resources to achieve an agrarian success that we have long since repudiated for our own central economic goals.

IN FACT, for the largest problems of producing calories and protein, agriculture may become obsolete. In a narrowly technical sense, we already know enough of scientific principle to replace farming by industrial chemistry. The underlying problem is, after all, merely that of converting energy into forms chemically available to the human stomach. Agriculture will then concentrate on specialty and luxury products like wool and beefsteaks.

The redirection of agriculture is the world's central technological decision, along with the rational control of population. But our efforts at a long view are now frustrated by the cries of present hunger and by our inability to perceive and plan a world economy for the next century when its politics makes mere survival a tangible question.

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